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The Compelling Need for a Comprehensive Approach to Scholarly Integrity

In both the public mind and in the minds of individuals who embark on careers in education and research, science represents many of our highest aspirations.[1] Scientists seek to understand how things work; to discover and uphold the truth, even when it challenges conventional beliefs; to benefit society; and to solve the world's most pressing intellectual and practical problems. Science, and research across all disciplines, is also a highly social activity. The social structures that make scientific discovery possible are competitive, and the excitement of competition drives discovery. But these social structures are also collaborative and collective, requiring individual researchers often to work in teams and always to contribute to the larger communal enterprise of scholarship and research. The public benefits of science make headlines every day, and the public's conception of a scientist typically includes the personality traits of honesty, altruism, and objectivity to complement the highest levels of educational achievement. "Scientist" has therefore regularly ranked among the top professions in terms of public confidence and esteem.

This public esteem for scientists bleeds over onto the institutions and the leaders of those institutions. The National Science Board's *Science and Engineering Indicators* (2002) found "Public Confidence of Leadership in Selected Institutions" from 1973-2000 to be highest for medicine and the scientific community, above that of the Supreme Court, education, and the press.[2] In the 2006 indicators, the confidence expressed in the science profession and its institutions remained at near its highest levels.[3] Overall, what is often described as the compact or covenant between science and society has been a successful one. Through this compact, public funds support scientific endeavors that in turn benefit the public through applications and education. The foundation of this compact is integrity.

In the broader academic context, integrity is a concept that encompasses understanding the minimal standards of compliance in research, the personal ethical decision-making processes of individuals, and ultimately the ways in which our institutions reflect the highest aspirations and broadest commitment on the part of the academic profession to the principles of truth, scholarship, and the responsible education of future scholars. Whenever integrity by any of these definitions is compromised, the breach of trust that can result has important consequences for the individual researchers, the institutions they represent, and society. Research integrity is not simply an individual value, it is also an institutional value reflected in the culture that is reinforced by the processes in place and the daily decisions of individual researchers, faculty and mentors, campus leaders, and administrative staff.

Recent efforts to place greater emphasis on research integrity are important in the context of three phenomena: (a) an increase in the number of reported cases of misconduct, nationally and internationally; (b) the encroachment of external pressures upon academic research as interaction and interdependence intensifies among academic, commercial, and government sectors; and (c) the expanding scope of researchers' responsibilities as a consequence of the globalization of the scientific community. The growing interaction among academic, business, and government sectors and the globalization of the scientific community both have the potential to provide enormous public benefits, but they also mean that the next generation of scholars faces new challenges. University leaders and scholars now must work together to ensure that a strong tradition of research integrity evolves to meet these new challenges. The continuing collaboration between CGS and member universities on research integrity is designed to support these efforts.

Important progress has already been made on this front through projects supported by the Office of Research Integrity (ORI) and the National Science Foundation (NSF), including ORI- and NSF-sponsored projects of the Council of Graduate Schools.[4] Many of the educational activities and projects that address the need for greater attention to research integrity in preparing students for a research career fall under the umbrella of "responsible conduct of research" (RCR). However, RCR has sometimes been interpreted to mean narrow "training" in response to compliance and regulatory

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issues. Curricular content and innovative approaches particular to the graduate education context have developed out of these programs, but many of these have been piecemeal, and materials have ranged from passive to minimally interactive, sometimes with an emphasis on brief workshops or online instruction that can be perceived as add-ons, incidental to the real curricular experience of a graduate degree program. The aims of the CGS Project for Scholarly Integrity are convergent with the advancement of the responsible conduct of research, but are broader and more inclusive than a "training model" would imply. Although increased compliance with professional standards by individual researchers would be difficult to measure within the time period of this project, we believe that the educational approach here will result in a community of scholars that is on the whole more compliant as a result of aspiring to a more comprehensive model of scholarly integrity.

Misconduct and Compliance Training

Advocates of enhancing education in research integrity frequently state that the scientific community must be especially vigilant because, among other reasons, highly visible incidents of misconduct threaten to undermine the public confidence in science. Of course this is true, and the research community has had its share of highly visible incidents of research misconduct. Most of these cases fall under the categories of the falsification and fabrication of data and plagiarism. Some of the most well-known cases in the U.S. over the last 25 years involve established researchers at prestigious universities and national labs. While the names associated with these incidents have captured the public attention, the popular press has, for the most part, laid the responsibility for them on the moral lapses of a few individuals. When cases of research misconduct attract attention, however, institutional leadership and the university name are also subject to public scrutiny. This may account for the sometimes serious discrepancies between the articulation of university ethics policies and their implementation. Administrators may fear that bringing cases of misconduct out into the open could jeopardize the reputation of their university. In fact, the high profile cases that have shaken the scientific community do not appear to have had much of an effect on public confidence in science.[5] The recent rise in allegations and cases of misconduct suggests, however, that far beyond the mistakes and possible moral lapses of the few, there may also be systemic or cultural forces at work that, if left unanswered, could affect the entire research enterprise.

A natural response of institutions to cases of serious misconduct is to intensify compliance training on the assumption that such cases could have been prevented through better understanding of the rules and professional standards for research. Availing faculty of opportunities to refresh their knowledge of professional standards is a good cause, but these serious misconduct cases can serve another important purpose. Graduate deans and other senior administrators such as presidents, chancellors, provosts, and vice presidents for research and division deans should see these cases not only as symptoms of institutional vulnerability, and therefore as opportunities for conversation about safeguards and programs for upholding the university's reputation for quality research, but also as occasions for holding more overarching campus-wide conversations about the role of integrity in the mission of the university and the fundamental importance of academic integrity across all sectors of the university.

Impact of External Pressures and Globalization on the New Research Culture

Systematic improvements are needed not only to uphold professional standards, but more importantly because the evolving complexity of the world of science and the place of the university in society require a comparable evolution in our educational approach to preparing the next generation of scholars. A more systematic approach than has been undertaken in the past, under the guidance of senior leaders, is crucial now because of changing dynamics in the broader research culture in the last half-century.

In *Science, The Endless Frontier*, his report to Harry S. Truman in July 1945 (requested a year earlier by President Franklin D. Roosevelt), Vannevar Bush asserted that America's colleges and universities "are uniquely qualified by tradition and by their special characteristics to carry on basic research." Within these institutions, "scientists may work in an atmosphere which is relatively free from the adverse pressure of convention, prejudice, or commercial necessity. At their best they provide the scientific worker with a strong sense of solidarity and security, as well as a substantial degree of personal intellectual freedom."[6] But as new technologies make research misbehavior both more possible and more easily discernable, a number of external pressures on scientists are making the incentives to "misbehave" stronger. One of the key responsibilities of all educators is to prepare students to thrive with integrity and professionalism in a research enterprise that is no longer as immune to the "adverse pressures" that Vannevar Bush identified a half-century ago. Hence, influential reports have encouraged stakeholders to work together to recognize "the role of the 'system' in contributing to incidences of research misconduct."[7]

The rapid pace of modern research compounded by the increased competition for grant funds creates additional pressure for conclusive findings, and the prompt publication of those findings diminishes the time and communal incentive for the self-regulatory processes of science to operate, via the replication and verification of experiments. In addition to these and other mounting external pressures facing researchers today, there are also unprecedented opportunities for one's research to have broad public benefit on a global scale. But with these opportunities come increased responsibilities and risks. Increasingly, research on a variety of topics with global applications requires scholars who can work effectively in interdisciplinary, interinstitutional, and international teams.

Such research also requires researchers who are sensitive to the ethical issues surrounding the sometimes unintended global uses and different cultural contexts that the products of one's research may encounter. Models of education in RCR, still largely focused on traditional ethics which stress the "proximity of ends" in "the immediate setting," may not yet be adequate to address the complexities of working in an intercultural and international context, where the consequences of one's research may lie outside one's immediate proximity, both geographically and temporally.[8] Ensuring the adequacy of our ethical models is especially important where life and death issues are concerned, and where the consequences of responsible and irresponsible conduct are magnified. A comprehensive values-based approach to research integrity will help the scholars we are now preparing in our graduate programs face these pressures with confidence and may help to attract a new generation of students.

Moving to a Values-based Approach to Research Integrity

Among the recommendations that emerged from a recent global conference on research ethics was the need for nations and institutions to strike a balance between "compliance-based" and "values-based" approaches in their policies and programs.[9] Federal agencies, like the leadership of U.S. graduate schools and universities, are justifiably concerned about the number of reported incidents of misconduct, pervasive patterns of misbehavior, and the financial and reputational costs related to such misbehavior. The National Institutes of Health has recently required, and the NSF is about to require, that recipients of federal funding involving graduate students and/or postdocs include education and training activities in responsible and ethical conduct of research. Such educational requirements send a clear signal that compliance is only one aspect of the federal approach to this problem. A values-based approach to graduate education in research integrity and professionalism is necessary both to obtain the essential support of research faculty and to render compliance-based efforts more effective.

Recently, researchers have emphasized the need to expand our definitions of ethical research behavior, and this expansion has important implications for the role that institutions can play in providing a policy and educational environment that encourages responsible and ethical conduct of research.[10] A values-based approach to addressing research integrity may require a serious assessment of the campus climate and difficult conversations about the factors within the university and the broader research environment that may contribute to misconduct as well as those that reinforce academic integrity. While most of the public attention has fallen on sanctionable offenses in falsification, fabrication, and plagiarism, and training has largely focused on compliance in these areas, important debates are taking place in the scientific community about the prevalence of a wider range of questionable research practices including laboratory, data, financial, and classroom management. Addressing the full gamut of professional responsibilities of scholars requires a fundamental change in traditional ways of providing research ethics education. Included therein are the responsibilities not only of individual researchers but also of institutions and institutional leaders who have the capacity to influence the overall research environment.

by Daniel Denecke, Program Director, Best Practices and Publications

Notes

[1]This is an abbreviated version of part one of a "framework document" prepared for the Council of Graduate Schools by Daniel D. Denecke that addresses the compelling need for a more comprehensive approach to scholarly integrity and identifies core issues that institutions need to address as they embark on such a project. CGS is grateful to members of the planning committee for the Project for Scholarly Integrity Jeffery Gibeling, Clarke Hulse, Bryan Noe, Suzanne Ortega, Lisa Tedesco, and Robert Thach and expert consultant Gregory Koski for their valuable input that informed and improved this document. CGS also thanks ORI for generous support of the project. The full version of the document is available on the CGS website: www.cgsnet.org.

[2]http://www.nsf.gov/statistics/seind02/mmslides/mm07-14/mm07-14.htm

[3]http://www.nsf.gov/statistics/seind06/c7/c7s3.htm

[4]See the web resources of ORI (http://ori.dhhs.gov/education/rcr_resources.shtml), NSF (http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13338), and CGS (www.cgsnet.org). See also Paul Tate, *Graduate Education for the Responsible Conduct of Research* (CGS 2006) and Nicholas Steneck, *An Introduction to the Responsible Conduct of Research* (ORI 2007).

[5]A 2006 Harris Poll found that the integrity of scientists is regarded by the public as highly as confidence in the leadership of their institutions cited earlier in this document. Scientists rank among the top three professions regarded as "most honest" (at 77%), behind only doctors (85%) and teachers (83%) (Harris Interactive, 2006), http://www.harrisinteractive.com/harris_poll/index.asp?PID=688

[6]http://www.nsf.gov/od/lpa/nsf50/vbush1945.htm

[7]*The Role and Activities of Scientific Societies in Promoting Research Integrity: A Report of a Conference* (AAAS & ORI, 2000), p.2, http://www.aaas.org/spp/sfrl/projects/report.pdf. See also *First World Conference on Research Integrity: Fostering Responsible Research – Official Final Conference Report* (ESF & ORI, 2007), http://www.esf.org/activities/esf-conferences/details/archives/2007/confdetail242.html, and *Integrity in Scientific Research: Creating an Environment That Promotes Responsible Conduct* (IOM & NRC, 2002).

[8]Hans Jonas, in *The Imperative of Responsibility* (Chicago: University of Chicago Press, 1984).

[9]http://www.icsu.org/5_abouticsu/PDF/WC_final_report.pdf

[10]See "Scientists Behaving Badly" (*Nature* 435(9), 737-738), Brian C. Martinson, Melissa S. Anderson and Raymond de Vries. See also D. Epstein, "The Real Science Ethics Issue," I*nside Higher Education*, April 24, 2006, http://www.insidehighered.com/news/2006/04/24/science; AAAS & ORI, 2000; and ESF & ORI, 2007, p.7.

Data Sources: Graduate Students in Distance Education, 2003-2004

In 1953, the University of Houston became the first postsecondary institution in the U.S. to offer college courses for academic credit via electronic media to students not enrolled on campus. Faculty at the university taught classes through KUHT, America's first public television station. The courses were broadcast live, and ran for 13 to 15 hours each week. Most courses aired in the evenings so that students who worked during the day could watch them. By the mid-1960s, with about one-third of the station's programming devoted to education, more than 100,000 semester hours had been taught on KUHT (KUHT Web site; Wikipedia Web site).

Over the next five decades, many more colleges and universities would join the University of Houston by offering distance-based education courses via electronic means. Distance education is generally defined as the delivery of courses, academic training, or academic materials by use of live, interactive television or audio, pre-recorded television or video, CD-ROM, or computer-based systems such as the Internet (NCES, 2006).The establishment of distance education programs greatly accelerated in the mid- and late-1990s, due to the advent of the World Wide Web and other advances in computer and other media technologies. The American Council on Education reports that the number of postsecondary institutions offering distance education programs rose 38% between academic year 1997-1998 and 2000-2001, and the number of students enrolled in distance courses or programs rose 85% (ACE, 2004). More recent data from the National Center for Education Statistics (NCES, 2006a) show that in 2006 nearly 87% of all four-year public colleges and 45% of four-year private, non-profit institutions in the U.S. offered one or more distance education classes or programs. Distance education is now seen as a way for institutions to meet the rising demand for higher education in a cost-effective manner (Howell, Williams, & Lindsay, 2008).

Much of the research on the use of distance education has focused on the participation of traditional-age undergraduates and adult learners seeking baccalaureate degrees (Oblinger, Barone, & Hawkins, 2003). However, information from the National Postsecondary Student Aid Study (NPSAS, NCES 2006b) reveals that more graduate students, particularly those over the age of 30, are also engaged in distance-based learning. In addition, the NPSAS data show that distance education students appear to be as satisfied with their electronically based courses as they are with classes taught in a traditional classroom setting.

The NPSAS study, sponsored by the National Center for Education Statistics (NCES), is a triennial survey of undergraduate and graduate/professional students enrolled at postsecondary institutions in the United States and Puerto Rico. The most recent graduate/professional study, which examined students enrolled during the 2003-2004 academic year (July 1, 2003 to June 30, 2004), is based on the enrollment, financial aid, and other records of 11,000 post-baccalaureate students. These students' data were statistically weighted so that they reflect the enrollment of the roughly 2.8 million students in graduate and professional degree and certificate programs during the study period. Student interviews were also used to document their enrollment and other activities. Data collected about enrollment in distance education programs are based on the student interviews (NCES, 2006b). The analysis that follows focuses on the distance education activities of the 2.2 million students in master's, doctoral, and post-baccalaureate certificate programs during the NPSAS study period.

The NPSAS data reveal that while graduate student involvement in electronically delivered courses is fairly widespread, the plurality of participants are concentrated in certificate and master's degree programs in a few key fields. Overall, about 22% of certificate students, 18% of master's candidates, and 11% of those seeking doctoral degrees in 2003-2004 took at least one distance education course for academic credit (see Table 1). The fields of study with the largest shares of distance education enrollment were business (21%), education (20%), and health sciences (17%). However, fewer than 10% of these students were using distance education for their entire academic programs, which suggests that most distance education students were using the electronic courses to supplement, rather than supplant, their classes at "bricks-and-mortar" universities.

Table 1: Percentage of Graduate Students in Distance Education Courses or Programs, 2003-2004

	% Taking Any Distance Education Courses	% Using Distance Education for Entire Program
Total	17%	7%
Graduate degree program		
Master's degree	18%	7%
Doctoral degree	11%	4%
Certificate	22%	7%
Gender		
Male	17%	6%
Female	17%	7%
Race-ethnicity (Domestic Students Only)		
White	19%	7%
African American	19%	8%
Latino	13%	5%
Asian*	14%	3%
Other	12%	5%
Age as of 12/31/03		
Under 30	13%	4%
30 to 39	20%	8%
40 & Older	20%	10%
Citizenship		
U.S. Citizens	17%	7%
Non-citizens	9%	3%
Graduate field of study		
Humanities and Social Sciences	9%	3%
Math, Science, and Engineering	12%	5%
Education	20%	8%
Business	21%	10%
Health	17%	6%
All Others	14%	4%

*Includes Pacific Islanders and Native Hawaiians.

Source: NCES, 2006b.

U.S. citizens were much more likely to be engaged in distance education than international students, and among domestic students, White, non-Hispanics and African Americans were more likely than Latinos or Asians to be enrolled in electronically delivered classes. However, students' age was the biggest determinate of their involvement with distance-based education. About 20% of the students age 30 and older used distance education for at least part of their academic programs, compared with only 13% of those under the age of 30. On-line and other distance-based programs attract older students primarily because they are better suited to working students' work and family life schedules (Howell, Williams, & Lindsay, 2008).

The rising use of distance education has brought with it concerns about academic quality, as campus leaders worry that electronically based courses are not taught as effectively as

those in traditional classroom settings (Eaton, 2003). However, the survey data suggests that the majority of graduate students participating in distance-based courses are satisfied with the education they receive. According to the NPSAS data, 32% of the master's students who took one or more distance-based classes were more satisfied with those classes than they were with their other types of courses, and another 39% were as satisfied with their distance classes as they were with any other class types (see Table 2). Older students were more likely to be satisfied with their distance programs than those under 30 years old, and business and education majors were more satisfied with distance learning than were students in other fields, particularly health sciences, which most likely would require the most in-person training and contact with instructors. Somewhat surprisingly, a higher share of students in certificate programs (37%) were dissatisfied with their distance classes than were master's and doctoral candidates (29%). Overall, the survey results suggest that roughly two-thirds of all students who took distance-based courses were at least as satisfied with their educational programs as those who did not.

Table 2. Level of Satisfaction with Graduate Distance Education Classes, 2003-2004*

	More Satisfied With Distance-Based Classes than other types of classes (%)	Liked Distance and Non-Distance Classes the Same (%)	Less satisfied With Distance Classes than Other Types of Classes (%)
Total	30%	40%	30%
Graduate degree program			
Master's degree	32%	39%	29%
Doctoral degree	23%	48%	29%
Certificate	21%	41%	37%
Gender			
Male	33%	36%	30%
Female	28%	43%	29%
Race-ethnicity (Domestic Students Only)			
White	29%	41%	30%
African American	39%	33%	28%
Latino	16%	46%	38%
Asian*	22%	48%	30%
Other	51%	32%	17%
Age as of 12/31/03			
Under 30	22%	40%	39%
30 to 39	32%	43%	25%
40 & Older	39%	39%	22%
Citizenship			
U.S. Citizens	30%	41%	29%
Non-citizens	24%	34%	43%
Graduate field of study			
Humanities and Social Sciences	28%	37%	35%
Math, Science, and Engineering	21%	51%	28%
Education	32%	45%	23%
Business	39%	32%	29%
Health	10%	37%	53%
All Others	24%	42%	34%

*Includes students who took at least one distance education course for academic credit.

Source: NCES, 2006(b).

Campus teachers also generally appear to be satisfied with teaching in a distance-based environment. A survey of college faculty conducted by Turco (undated) found that college professors believe courses taught electronically are able to provide students with greater access to information and are better able to adapt to differences in students' learning styles than in-person courses. However, faculty also believe that traditional classrooms are better able than electronic ones to improve students' group problem-solving and oral presentation abilities. The need for improvement in communication skills will likely cause graduate students to use distance education sparingly.

While distance education students tend to be older and have other demographic differences than their peers in traditional classrooms, their receipt of financial support for graduate studies is surprisingly similar. As Table 3 shows, 69% of students in distance education graduate programs received financial aid, which is nearly identical to those who did not participate in any electronically delivered courses (72%).

Table 3. Receipt of Financial Aid Awards and Average Aid Amounts for Graduate Students by Level of Participation in Distance Education Courses or Programs, 2003-2004

	% Receiving Any Aid	Avg Total Aid Amount	% Receiving Grants*	Avg. Grant Amount	% Receiving Assistantships**	Avg. Assistantship Amount**	% Receiving Loans	Avg. Loan Amount
No Distance Education Courses								
Total	72%	$13,646	40%	$6,128	19%	$10,567	38%	$13,847
Graduate degree program								
Master's degree	71%	$11,882	38%	$4,614	14%	$8,328	40%	$13,415
Doctoral degree	84%	$20,789	56%	$10,647	44%	$13,400	30%	$17,906
Certificate	52%	$7,524	23%	$2,908	4%	Low N	33%	$8,590
One or More Distance Education Courses								
Total	69%	$10,913	40%	$3,984	8%	$7,706	37%	$13,895
Graduate degree program								
Master's degree	70%	$10,718	42%	$3,848	7%	$7,622	38%	$13,822
Doctoral degree	73%	$14,690	43%	$5,872	16%	$10,245	38%	$17,317
Certificate	42%	$4,560	22%	Low N	9%	Low N	22%	Low N

*Includes scholarships and fellowships.
**Includes research and teaching assistantships. The average awards are based on levels of stipends, but do not include any tuition waivers or other benefits.

Source: NCES, 2006b. "Low N" means the NPSAS survey sample size was too low to calculate reliable estimate.

The types of aid received by distance- and non-distance-based students do differ somewhat, however. About 44% of the doctoral candidates who did not take any distance courses received teaching or research assistantships, compared with just 19% of those who took one or more electronically taught classes. Doctoral students in non-distance classes also were more likely to have received grants and scholarships, 56% versus 43%. On the other hand, distance education students in doctoral program were more likely to take student loans (38% compared with 30%). The different academic structures may account for the differences in types of aid received. For example, distance students may not be able to come to campus regularly enough to qualify for assistantships, and thus may be more reliant on loans. Nonetheless, distance education students appear to be as likely as their non-distance peers to receive financial support for graduate education.

The available evidence suggests that an increasing number of graduate students, particularly master's and certificate candidates, are participating in distance-based courses or programs. Distance education has a number of advantages: It serves a large number of students, especially those age 30 and older, who tend to use it to supplement the teaching and training they receive from more traditional classroom settings; students in all fields of study except health sciences appear to be as satisfied with their distance-based courses as they are their traditional ones; and students in distance programs appear to be as likely to receive financial support for their education as those taking courses on-campus classes exclusively. Distance-based training thus may provide an alternative for at least some graduate students.

But it is also clear that distance education will never completely replace traditional classroom education at the graduate level. While faculty seem satisfied with their ability to teach classes with electronic media, they cannot easily use technology to replicate the group projects or communications

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Forum on Graduate Education and the Public Good

At a legislative forum CGS sponsored on Thursday, April 24th at the Library of Congress, nearly 100 policymakers, business and nonprofit leaders, and higher education stakeholders assembled to discuss the connection between graduate education and the public good. The forum was held to release CGS' new report *Graduate Education and the Public Good* and its companion document *Making a Difference*.

The publications demonstrate how a world-class graduate education system has benefited the United States by highlighting examples of people who have earned graduate degrees from U.S. universities and have gone on to make important contributions at the local, state, national, and international levels. These "exemplars," nominated by CGS member institutions, range from public health researchers to entrepreneurs, middle school teachers to playwrights, all contributing in myriad ways to the benefit of the populace at large.

Moira Gunn, Debra Stewart, Mary Good, and Allen Atkins at the CGS Legislative Forum.

Debra W. Stewart, CGS President, welcomed the attendees and noted that the purpose of the forum was to hear firsthand from policymakers and exemplars how graduate education contributes to the public good. She noted that while 34 people were selected to be highlighted in the report, all of the eligible exemplars nominated were included in *Making a Difference*—over 300 graduates, nominated by 134 institutions.

Several members of Congress then brought their perspectives to the issue. Representative Silvestre Reyes (D-TX) illustrated the importance of highly-skilled graduates to our national security by describing his experience as Chairman of the House Select Intelligence Committee. He added that student diversity in graduate education is crucial and that he and his colleagues are working through the newly-created Diversity and Innovation Caucus to provide more opportunities for underrepresented groups.

Rep. Lois Capps (D-CA), herself an exemplar nominated by the University of California, Santa Barbara, brought a personal perspective to the importance of graduate education by describing the difference it has made in her life and in the lives of many of her family members. She went on to renew her commitment to education and graduate education in particular.

Rep. Rush Holt (D-NJ), a physicist by training, emphasized the value of the report and the connection it draws between graduate education and our nation's prosperity. He asserted his support for federal funding for fellowship opportunities in order to maintain America's preeminence in graduate education.

The panels that followed consisted of eight graduate degree holders whose accomplishments were highlighted in the report; they each brought a unique personal story.

The first panel's participants presented employers' perspectives on how critical graduate education is to an organization's success to have the right employees with the right training. Joann Eisenhart, Vice President for Human Resources for Pfizer Inc. and someone who has earned two doctorates, spoke about the importance of having scientists with graduate training working throughout the drug manufacturing process. Skilled graduates save lives, since the drug discovery and testing process cannot function without them; to her the value of graduate education is measured in the additional years of life available to patients provided by breakthrough drugs.

Carmichael Roberts holds a Ph.D. and an M.B.A. His work through North Bridge Venture Partners, a venture capital company he co-founded, helps establish new innovative companies in the biotechnology and other sectors. He explained how people with graduate degrees were integral to nearly every company he has helped build.

Next, a panel of exemplars with doctoral degrees spoke about their individual experiences and the most important way graduate education has helped them succeed and contribute to the public good. Moira Gunn, host of National Public Radio's "Tech Nation" program, helps ordinary people understand complex technological issues. Her graduate training continues to help her, by enabling her to tackle the new realm of biotech, an area in which she has no formal training. The ways of thinking and the ability to research and understand a complex issue that she learned in graduate school made a huge difference.

She was followed by Allen Atkins, former Vice President of Boeing Phantom Works. He has had a long career working with federal government "stealth" engineering programs. He believes that the most important thing a graduate can take from a graduate program is an attitude that no matter what, they can accomplish anything. Mary Good, Dean and Donaghey Professor at the University of Arkansas in Little Rock's Donaghey College of Engineering and Information Technology, then spoke about the importance of her years as a graduate student in laying the foundation for her future career. After success in the nonprofit, government, and business sectors, she has returned to academia at her alma mater because mentoring and shepherding the next generation of graduates is critically important to the future of our country.

The final panel consisted of three master's degree holders who are working in their communities for the good of society. Judi Frerick, Assistant Professor of Nursing at Northern Kentucky University, described the health crisis

affecting Kentucky and her work collaborating with local nurses and organizations to address those issues. After receiving her degree, she remained at Northern Kentucky University to teach nursing courses; this is crucial since our nation faces a shortage of health professionals.

Marco Figueiredo has founded multiple nonprofit organizations including the Loyola Center for Community Informatics in Baltimore. His efforts have improved access to information technology for low-income individuals and families in the U.S. and in his native Brazil. Finally, Carole Artigiani, Chief Executive Officer of GlobalKids, shared her story. She received a master's in women's history, and the organization she founded has helped transform over 100,000 at-risk New York City teens into global citizens, working on such issues as human rights, global health, and ethnic conflict.

William Russel, Chair of the CGS Board of Directors and Dean of the Graduate School at Princeton University, closed the forum by reemphasizing the connection between graduate education and the public good. In a Q&A session, an audience member noted that students want to go into careers that serve more than just their personal interest. This report is not just for policymakers, it is also a useful tool for showing students how a graduate degree can equip them to improve peoples' lives at the local, state, national or even global level.

The report and companion document are available as a set from the CGS website.

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Data Sources

skills that are needed for complete success in graduate education. In addition, students will always want social interaction with faculty and fellow students. As Turco (undated, pg. 322) points out: "As our society becomes more dependent upon impersonal telecommunications technologies in the marketplace, many people will eventually long for more personal interactions."

By Kenneth E. Redd, Director, Research and Policy Analysis

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